

Newborn Critical Care Center (NCCC) Guidelines

Umbilical Lines (UAC / UVC)

GENERAL INFORMATION

Umbilical vein and/or artery catheterization is an imperative and potentially life-saving measure performed in UNC Neonatal Critical Care Unit (NCCC) for critically ill infants, both premature and term, that require timely and reliable vascular access for the administration of fluids (e.g. parenteral nutrition, crystalloid, colloid, and medications), the obtainment of laboratory values, as well as accurate and continuous blood pressure monitoring.

I. Indications for Placement

- A. Umbilical Arterial Catheterization (UAC)
 - 1. Frequent monitoring of arterial blood gases and/or blood sampling
 - 2. Continuous monitoring of arterial blood pressure
 - 3. Infusion of maintenance glucose/electrolytes solutions (if no venous access)
 - 4. Exchange transfusion

- B. Umbilical Venous Catheterization (UVC)
 - 1. Emergency vascular access for fluid resuscitation and medication administration
 - 2. Initial central venous access in extremely low-birthweight infants (ELBW)
 - 3. Hypertonic fluid requirements
 - 4. Vasoactive drug administration (e.g. inotropes and vasopressors)
 - 5. Continuous monitoring of central venous blood pressure
 - 6. Exchange transfusion

II. Insertion of Lines

- A. Preferably prior to delivery, collect and set-up the necessary equipment:
 - 1. Umbilical Catheter Insertion Tray
 - 2. Venous and Arterial Catheters
 - a. One UAC Catheter - 3.5 Fr or 5.0 Fr single lumen catheter
 - b. One UVC Catheter - 3.5 Fr or 5.0 Fr double or single lumen catheter
 - c. Catheter Size
 - i. For infants \leq 1500 grams, use a 3.5 Fr catheter
 - ii. For infants $>$ 1500 grams, use a 5 Fr catheter
 - 3. Scalpel
 - 4. Chlorhexidine or Betadine as deemed appropriate by weight/gestational age
****All premature infants weighing < 1000 grams ONLY USE BETADINE**
 - 5. Two silk sutures (3-0 or 4-0)
 - 6. Sterile gown, sterile gloves (ask provider what size), hat, and mask
 - 7. Sterile saline syringes (or 5% Dextrose syringes for ELBWs)
 - 8. Three way stop cocks (one three way stop cock per lumen)
 - 9. Minimum of four 3 mL syringes
 - 10. Two 5 mL syringes

- B. Order the procedure:
1. Under Order Sets, select Neonatal Procedure Focused and open the order set
 2. Click on Procedural Pain/Sedation and select desired medications if indicated
 3. Click on intra-venous fluids (IVF) and choose desired solutions if not previously ordered
 4. Click on Procedure/Nursing
 5. Select UAC Procedure
 6. Select UVC Procedure
- C. Before placing lines, ensure blood glucose and vital signs have been checked, and if necessary a peripheral IV has been placed (i.e. for hypoglycemia). **Be mindful of the time taken to perform the procedure.**

Umbilical line placement is a sterile procedure. Everyone in the pod needs to wear a sterile hat and mask, including family members and visitors.

- D. Secure infant in a position that is optimal for line placement
1. Swaddle legs and tuck arms to prevent possible contamination of umbilical area
- E. Perform hand hygiene
- F. Identify an assistant or nurse who can be available throughout the procedure
- G. Provide sedation if indicated
- H. Perform a time-out prior to beginning the procedure, to include:
1. The RIGHT patient
 2. The RIGHT procedure
 3. The RIGHT site
- I. Placement
1. UAC
 - a) High lines are placed in the descending aorta above the diaphragm and below the take-off point of the subclavian artery, with the tip optimally positioned between T6 and T9
 - b) Low lines are not preferred, as they are at higher risk for displacement; however, if needed for access, low lines should be securely positioned between L3 and L4. (Attending or fellow approval needed.)
 - c) Methods to calculate the **DEPTH OF INSERTION** for a high UAC:
 - (1) $[\text{Birth Weight (kg)} \times 3] + 9$
 - (2) Umbilical stump to shoulder distance + 1cm (or + 2cm in term infants)

For either method, make sure to account for the length of the umbilical stump.
 - d) Once inserted, lines may not be advanced **unless the field remains sterile**

e) False Tracking

- (1) The **artery must be dilated prior to insertion** of the catheter to prevent "false tracking," a phenomenon where the catheter tracks outside the lumen itself
- (2) **Only attempt one of the two arteries for catheterization.** Ask an attending, nurse practitioner, or fellow prior to cannulating the second arterial lumen

2. UVC

- a) During an **emergency/resuscitation**: Advance UVC only until blood return is noted
- b) The tip of the UVC should be located above the level of the diaphragm at the junction of the inferior vena cava and right atrium
- c) To calculate the **DEPTH OF PLACEMENT in cm**:

$$\boxed{[\text{UAC depth} / 2] + 1 \text{ cm OR } 1.5 \times \text{wt (kg)} + 5.5}$$

** Remember to include the length of the umbilical stump*

J. Type of Catheter

1. UAC

- a) Use 5 Fr catheter for term infants and infants > 1500 grams
- b) Use 3.5 Fr catheter for infants ≤ 1500 grams
- c) Use 2.5 Fr for ELBW that will not accommodate a 3.5 Fr catheter

2. UVC

- a) Consider the number of lumens the individual patient will need
- b) Size of the catheter may be individualized based on the size of the infant

3. Double-Lumen UVC

- a) Infants that usually should receive dual-lumen UVC access:
 - (1) Congenital **Cyanotic** Heart Disease
 - (2) Persistent Pulmonary Hypertension
 - (3) Severe Meconium Aspiration Syndrome
 - (4) Hypoxic Ischemic Encephalopathy / Whole Body Hypothermia
 - (5) Significant hemorrhage / abruption
 - (6) Prolonged resuscitation
- b) Infants < 750gm or < 25 weeks' GA, consider dual-lumen UVC if:
 - (1) Unable to successfully place a UAC
 - (2) Significant hemorrhage / abruption
 - (3) Prolonged resuscitation

K. Type of Fluid

1. Heparin (0.5 units/mL) should be added to all UAC and UVC fluids

2. **Fluids / medications that should NOT be infused into a UAC**
 - a) **Dopamine, Dobutamine, Epinephrine (inotropes)**
 - b) **Calcium boluses**
 - c) **Indomethacin / Ibuprofen Lysine**
3. UVC may be used for any type of fluid, medication and/or blood product.
4. Blood may be infused through a UAC if there is no alternate venous access.
5. TPN may be infused through a UAC if there is no alternate venous access
6. Prostaglandin E1 may be infused through a UAC if necessary, though ideally the PGE infusion should not be interrupted.

L. Placement Confirmation

1. Immediately after placement and suturing of catheter(s), and before obtaining the radiograph for line placement, inspect the infant's buttocks and back, looking for signs of decreased perfusion that would suggest that the catheter has been inadvertently placed in a gluteal or spinal artery. If these areas appear dusky, remove the catheter immediately, and call the fellow or attending.
2. Separate catheters **externally** on the field to allow easier differentiation on radiographs
 - a) Place UVC on the right side of the patient, and UAC on the left side of the patient.
 - b) Make sure the patient is completely supine with shoulders and hips in alignment
 - c) Make sure all other lines and tubes are not crossing the chest, thus obscuring the visibility of the catheter tip.
 - d) Make sure the infant is not lying on anything that would obscure radiographic placement of the catheters.
3. Obtain KUB that includes the chest and lower pelvis to verify placement of lines
 - a) Page the XRAY STAT pager through the directory with message stating:
"Ready now in NCCC" if order for Umbilical Line Placement KUB was placed through order set.
4. Follow each line to differentiate the UVC from the UAC so that the appropriate placement may be noted.
5. If the UVC line appears at or just below the edge of the liver, obtain a cross table lateral to confirm the location of the UVC tip.
6. Placement may also be confirmed by trans-thoracic echocardiography.

M. Considerations

1. Remove catheter(s) as soon as clinically indicated. Consider indications for PICC placement. The risk of infection from a UVC increases significantly after as little as 3 days especially in preterm infants.
2. Under most circumstances the UAC should be removed prior to advancing enteral feeds above trophic volumes (20-30 mL/kg/day)

3. Recognize that the infection risks associated with replacing a UV are not known but could be substantially higher than an initial placement due to colonization of the site with bacteria over time. Discuss with fellow and/or attending before attempting.

N. Post-Procedure

1. Providers must write a procedure note which must be linked with the procedure previously ordered.
2. Route the note to the supervising physician.
3. Nursing should complete the central line / CABS I documentation per unit protocol.

References:

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2. Barrington KJ. Umbilical artery catheters in the newborn: effects of position of the catheter tip. *Cochrane Database of Systematic Reviews* 1999, Issue 1. Art. No.: CD000505. DOI: 10.1002/14651858.CD000505.
3. Furdon, SA., Hogan, MJ., Bradshaw, WT., & Clark, DA. Nurses' guide to early detection of umbilical arterial catheter complications in infants. *Advances in Neonatal Care*. Issue: Volume 6(5), October 2006, p242-256.
4. Gordon A, Greenhalgh M, McGuire W. Early planned removal of umbilical venous catheters to prevent infection in newborn infants. *Cochrane Database of Systematic Reviews* 2017, Issue 10.
5. Wortham, BM, Gaitatzes, CG, Rais-Bahrami, K. Umbilical Artery Catheterization. In MacDonald, M. & Ramasethu, R, eds. *Atlas of Procedures in Neonatology*, 4th ed. Philadelphia, PA: Wolter Kluwer/Lippincott Williams&Wilkins; 2007. p. 157-176.
6. Wortham, BM, Rais-Bahram, K. Umbilical Vein Catheterization. In MacDonald, M. & Ramasethu, R, eds. *Atlas of Procedures in Neonatology*, 4th ed. Philadelphia, PA: Wolter Kluwer/Lippincott Williams&Wilkins; 2007. p. 177-185.
7. CDC: Recommendations for Prevention and Control of Infections in Neonatal Intensive Care Unit Patients: Central Line-associated Blood Stream Infections: <https://www.cdc.gov/infectioncontrol/guidelines/nicu-clabsi/index.html>